

WHAT IS CLAIMED IS:

1. A throttle device for an internal combustion engine comprising an electric drive actuator for opening and closing a throttle valve to control an intake air flow rate of the internal combustion engine, and a default opening degree setting mechanism for keeping an opening degree of said throttle valve at a preset opening degree (hereinafter, the preset opening degree is defined as a default opening degree) larger than a full close position when said electric drive actuator is not energized, wherein
  - 10 a gear case for containing a gear mechanism to transmit power of said electric drive actuator to a throttle valve shaft is arranged on an outer wall of a throttle body, and a returning spring for acting a spring force on said throttle valve in a closing direction and a spring (hereinafter, referred to as a default spring) for acting a spring force on said throttle valve in a direction toward a side of the default opening degree seeing from the full close position of the throttle valve have diameters different from each other, both of said springs being held around a shaft of said throttle valve shaft and arranged between a gear attached to said throttle valve shaft in said gear mechanism and a wall portion of the throttle body.
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2. A throttle device for an internal combustion engine according to claim 1, wherein at least a part of one spring among said returning spring and said default spring having a smaller diameter is inserted inside the other spring having a larger diameter.
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diameter, and the spring having the larger diameter is placed in being guided by an outer periphery of a bearing containing boss for the throttle valve shaft projecting inward of said gear case in a manner that one end of the spring having the larger diameter is fixed to the wall portion of the throttle body.

5. 3. A throttle device for an internal combustion engine according to any one of claim 1 and claim 2, wherein a diameter of a final stage gear provided in said throttle valve shaft is 10 larger than an outer diameter of a spring having a larger outer diameter out of said returning spring and said default spring, and said final stage gear is engaged with an intermediate gear.

10. 4. A throttle device for an internal combustion engine according to any one of claim 1 to claim 3, which comprises an 15 engaging element (hereinafter, referred to as a fixing side engaging element) fixed to said throttle valve shaft, and an engaging element (hereinafter, referred to as a moving side engaging element) idly inserted onto said throttle valve shaft 20 and rotatable relative to said throttle valve shaft, wherein said default spring connects between a spring fastening portion of said moving side engaging element and a spring fastening portion of said throttle valve shaft so that said fixing side engaging element and said moving side engaging element attract each other, 25 said returning spring acting a force on said moving side engaging element in the direction closing the throttle valve, said fixing

side engaging element and said moving side engaging element being engaged and rotatable together opposing against a force of said returning spring within a range of opening degrees larger than the default opening degree, only said fixed side engaging element 5 being set rotatable together with the throttle valve shaft opposing against a force of said default spring by blocking movement of said moving side engaging element by a default opening degree setting stopper within a range of opening degrees smaller than the default opening degree, said returning spring and said 10 default spring being arranged around the shaft of said throttle valve shaft so that said returning spring is placed outside and said default spring is placed inside.

5. A throttle device for an internal combustion engine 15 according to any one of claim 1 to claim 3, which comprises a fixing side engaging element fixed to said throttle valve shaft and a moving side engaging element idly inserted onto said throttle valve shaft and rotatable relative to said throttle valve shaft, wherein said returning spring connects between a 20 spring fastening portion of said moving side engaging element and a spring fastening portion of said throttle valve shaft so that said fixing side engaging element and said moving side engaging element attract each other, said default spring acting a force on said moving side engaging element in the direction opening the 25 throttle valve, said fixing side engaging element and said moving side engaging element being engaged and rotatable together

opposing against a force of said default spring within a range of opening degrees larger than the default opening degree, only said fixed side engaging element being set rotatable together with the throttle valve shaft opposing against a force of said returning spring by blocking movement of said moving side engaging element by a default opening degree setting stopper within a range of opening degrees smaller than the default opening degree, said returning spring and said default spring being arranged around the shaft of said throttle valve shaft so that 5 said default spring is placed outside and said returning spring 10 is placed inside.

6. A throttle device for an internal combustion engine according to any one of claim 4 and claim 5, wherein said moving 15 side engaging element is placed between the wall portion of said throttle body and said fixing side engaging element, and a cylindrical collar member divided into two portions in an axial direction is placed between an inner periphery of a spring out of said default spring and said returning spring placed between 20 said moving side engaging element and said fixing side engaging element and an outer periphery of said throttle valve shaft.

7. A throttle device for an internal combustion engine according to any one of claim 4 to claim 6, wherein the gear 25 attached to said throttle valve shaft in said gear mechanism also serves as said fixing side engaging element.

8. A throttle device for an internal combustion engine according to any one of claim 4 to claim 7, wherein said moving side engaging element is composed of a cylinder portion with bottom having an inner diameter larger than an outer diameter of one spring out of said default spring and said returning spring having a smaller diameter and an alligator portion formed in an opening periphery of said cylinder portion with bottom, and a part of the other spring having a larger diameter is inserted on an outer periphery of said cylinder portion with bottom and supported with a surface of said alligator portion.

9. A throttle device for an internal combustion engine comprising an electric drive actuator for opening and closing a throttle valve to control an intake air flow rate of the internal combustion engine, wherein

a throttle body, a motor case containing a motor composing an electric drive actuator and a containing portion of a connector connecting by plugging to a motor terminal provided in an end plate of said motor are formed in a unit, and

a motor terminal extracting port for exposing said motor terminal to said containing portion of the connector is formed on a bottom portion of said motor case, and a guide for guiding said connector to said motor terminal extracting port when said connector is plugged to said motor terminal is formed on an inner wall surface of said containing portion of the connector.

10. A throttle device for an internal combustion engine comprising an electric drive actuator for opening and closing a throttle valve to control an intake air flow rate of the internal  
5 combustion engine, a motor case for containing a motor composing said electric drive actuator being integrated with a throttle body in a unit, wherein

in said throttle body, a motor terminal extracting port is formed in a side of a bottom portion of said motor case, a 10 containing space of a connector to be connected to the motor terminal being formed adjacent to the side of the bottom portion of said motor case, the containing space of the connector and a containing space for containing a throttle sensor provided at one end of a throttle valve shaft being formed in one room, a wire 15 lead portion of said throttle sensor being arranged in being directed to said containing space of the motor terminal connector.

11. A throttle device for an internal combustion engine according to claim 10, wherein a connector and throttle sensor 20 case which forms said containing space of the motor terminal connector and said containing space for containing the throttle sensor in one room is covered with a cover, and a wiring guide for gathering electric power wires to be connected to said connector and lead wires of said throttle sensor to one position 25 to pass therethrough is inserted into a groove provided on a wall

portion of said connector and throttle sensor case to be attached with said cover.

12. A throttle device for an internal combustion engine  
5 according to claim 11, wherein a belt-shaped metal member for holding a plurality of connectors is welded on an outer surface of said cover.

13. A throttle device for an internal combustion engine comprising an electric drive actuator for opening and closing a throttle valve to control an intake air flow rate of the internal combustion engine, a motor case for containing a motor composing said electric drive actuator and a gear case for containing a gear mechanism to transmit power of said motor to a throttle valve 15 shaft being integrated in a unit, wherein

a motor inserting port of said motor case is opened to said gear case, said motor being attached to said motor case by fastening a motor bracket to triangular point arranged screw holes provided a periphery of said motor inserting port with three 20 screws in total, three sides forming a contour of said motor bracket being curved lines, a motor positioning portion fitting to the three curved lines of said motor bracket to position the motor being formed in said gear case.

25 14. A throttle device for an internal combustion engine comprising an electric drive actuator for opening and closing a

throttle valve based on a signal controlling an intake air flow rate of the internal combustion engine, wherein  
a gap between a throttle valve shaft and a shaft inserting through hole for guiding said throttle valve shaft to a bearing  
5 provided in a wall portion of a throttle body is filled with an air leak preventing material, and a minimum opening degree on control purpose of said throttle valve is set to a value larger than an amount of overshoot of said throttle valve occurring when opening degree of said throttle valve is changed from a maximum  
10 opening degree on control purpose of said throttle valve to the minimum opening degree.

15. A throttle device for an internal combustion engine comprising an electric drive actuator for opening and closing a  
15 throttle valve based on a signal controlling an intake air flow rate of the internal combustion engine, wherein a gap between a throttle valve shaft driven to open and close the throttle valve by said electric drive actuator and a shaft inserting through hole for guiding said throttle valve shaft to a bearing provided in a wall portion of a throttle body is filled with an air leak preventing material.

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25 16. A throttle device for an internal combustion engine comprising an electric drive actuator for opening and closing a throttle valve based on a signal controlling an intake air flow rate of the internal combustion engine, wherein

a minimum opening degree on control purpose of said throttle valve is set to such a value that said throttle valve does not hit to a full close stopper by an overshoot of said throttle valve occurring when said throttle valve is changed from 5 a maximum opening degree on control purpose of said throttle valve to the minimum opening degree.

17. A throttle device for an internal combustion engine according to any one of claim 14 and claim 15, wherein said air 10 leak preventing material is molybdenum disulfide, and applied onto portions limited to between said throttle valve shaft and said shaft inserting through hole and the surrounding among portions around an outer periphery of said throttle valve.

15 18. A throttle device for an internal combustion engine comprising an electric drive actuator for opening and closing a throttle valve to control an intake air flow rate of an internal combustion engine, wherein

20 an electromagnetic shield member of a wire used for driving control of the electric drive actuator is a woven shield composed of a tube-shaped member formed by weaving glass fiber and a woven thin metal wire member covering the tube-shaped member.